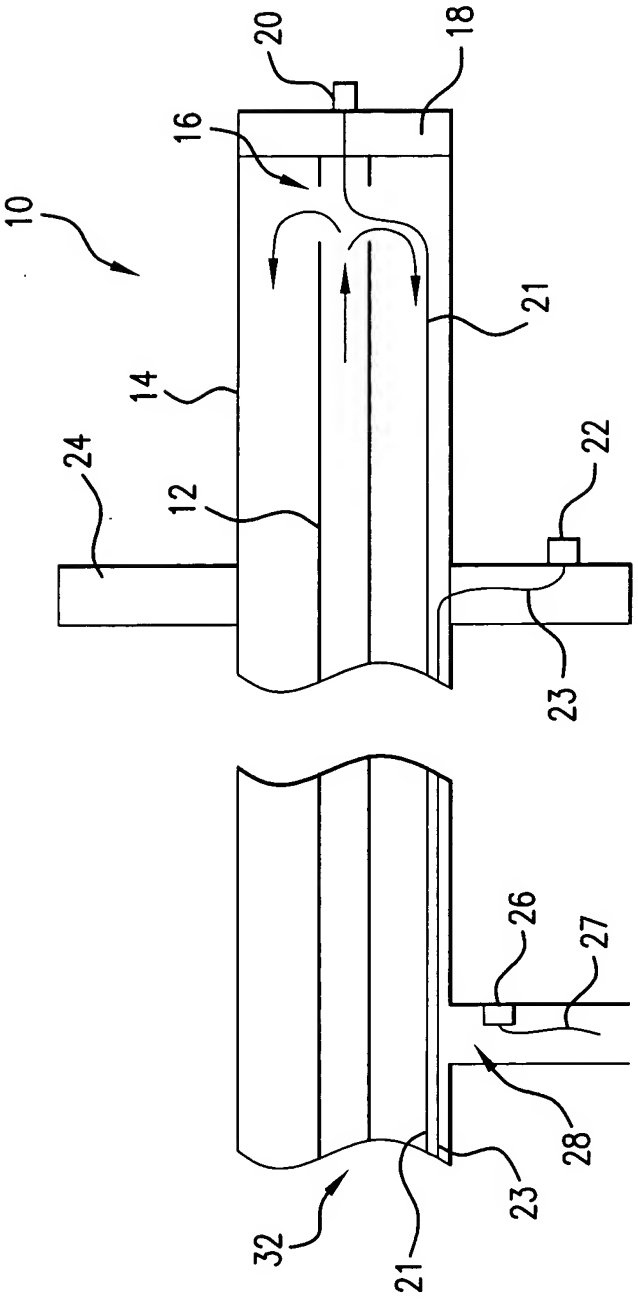

FIG. 1

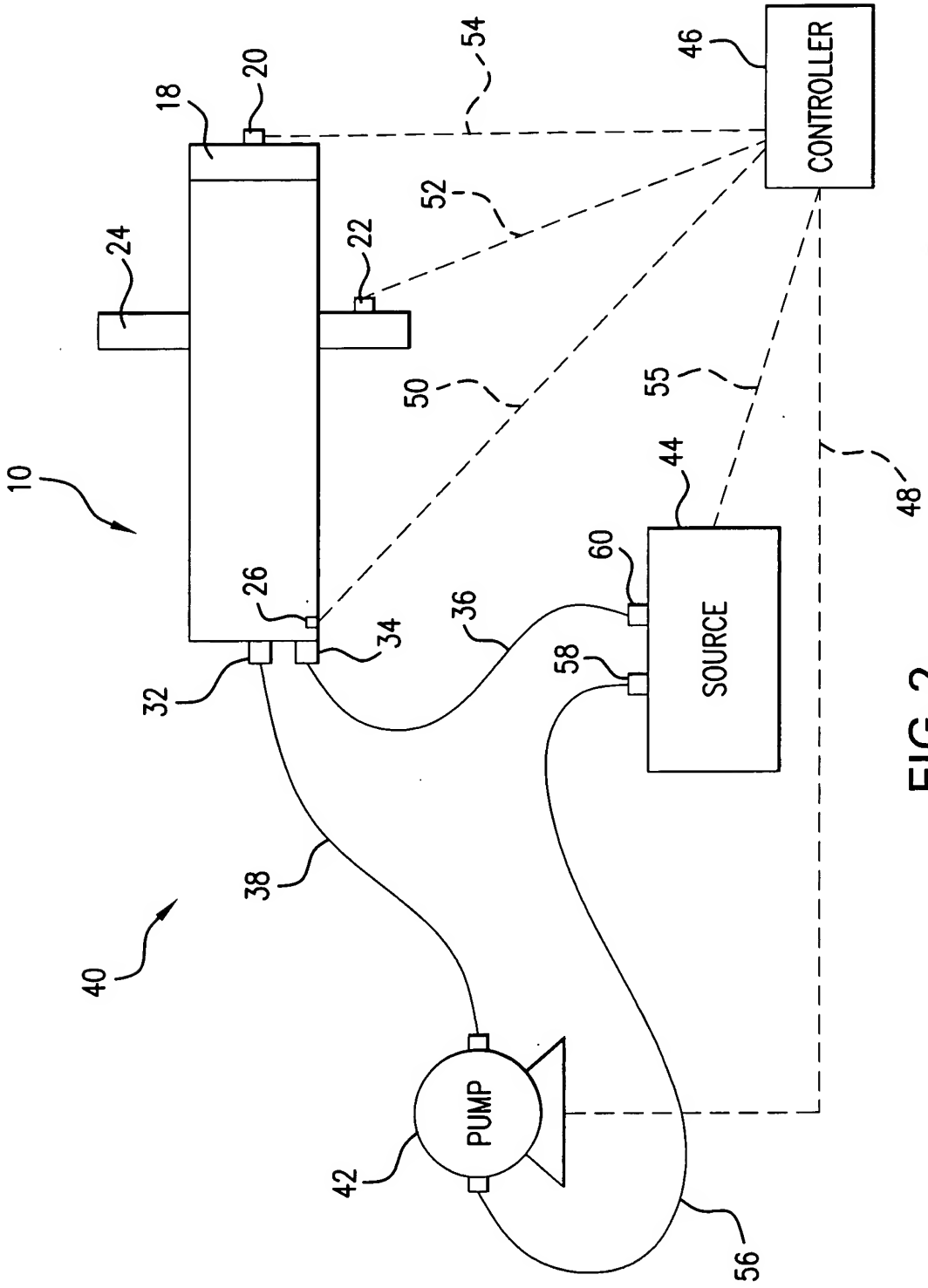
CONTROLLER
SOURCE
PUMP
10
18
20
22
24
26
32
34
36
38
40
42
44
46
48
50
52
54
55
56
58
60

FIG. 2

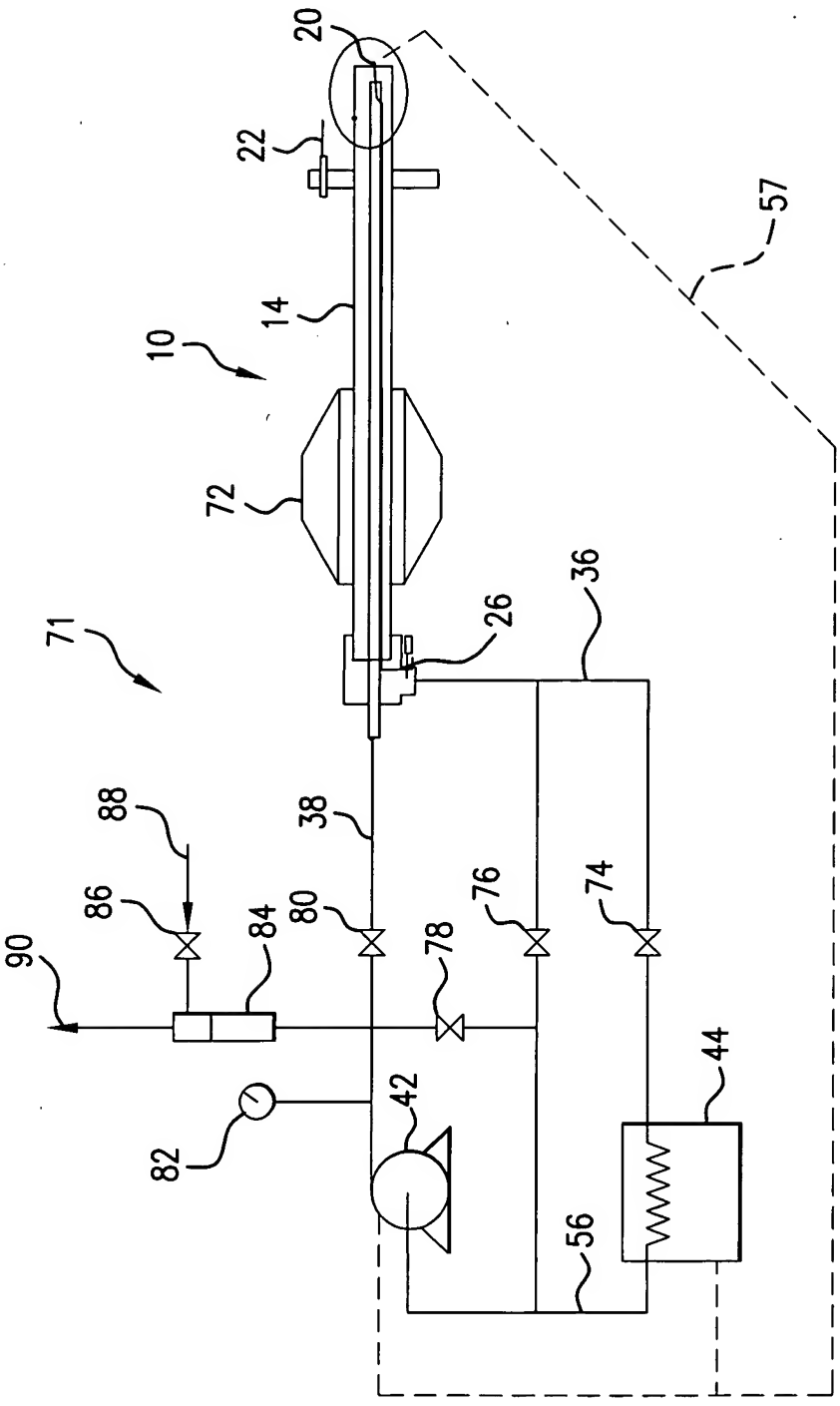

FIG.3

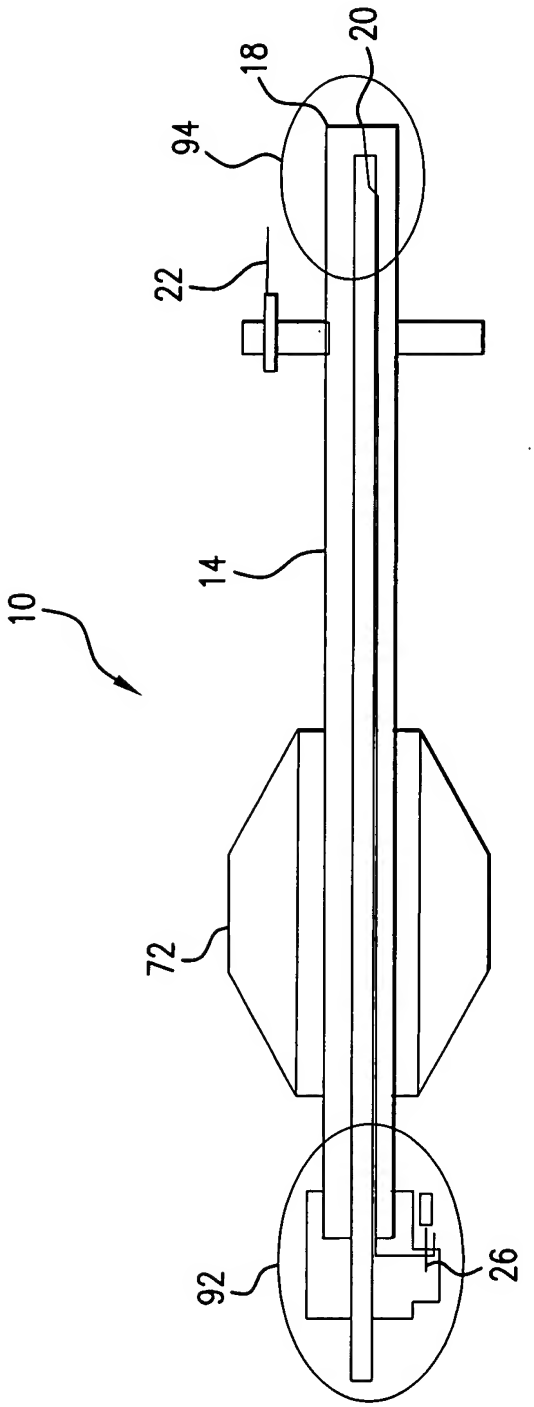

FIG.4

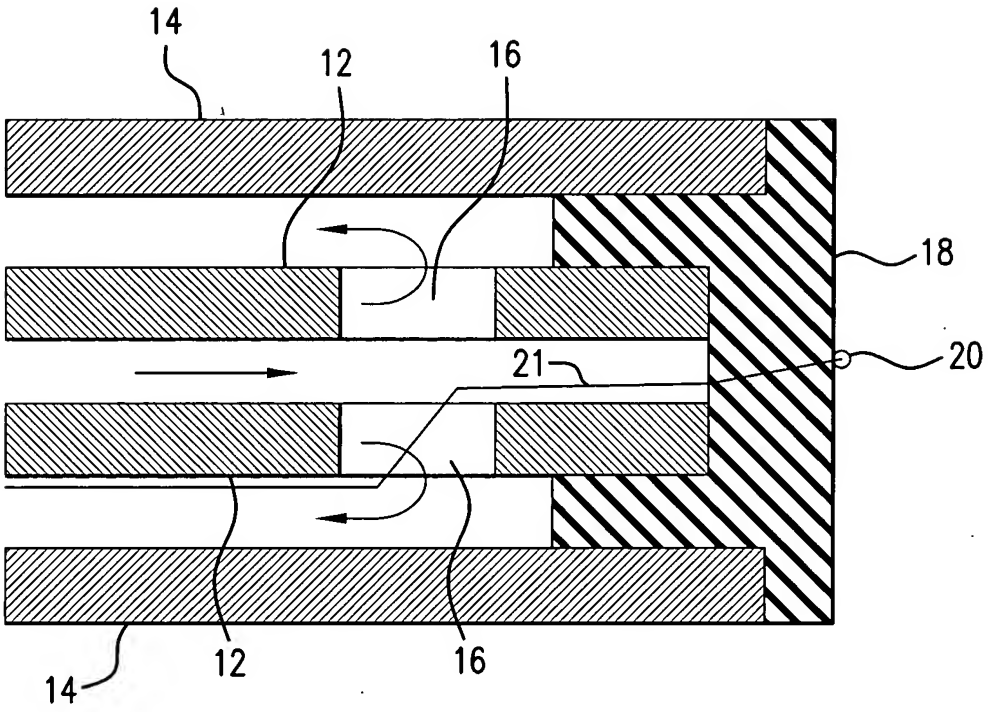

FIG.5

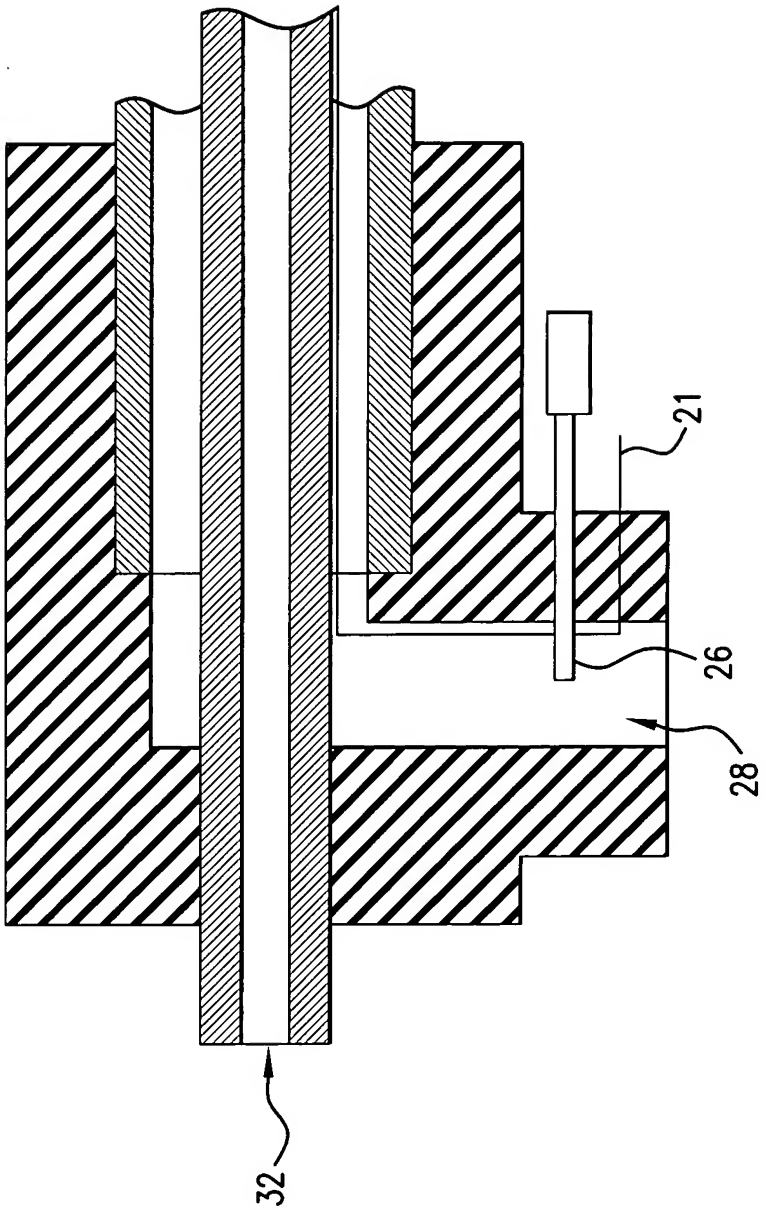

FIG.6

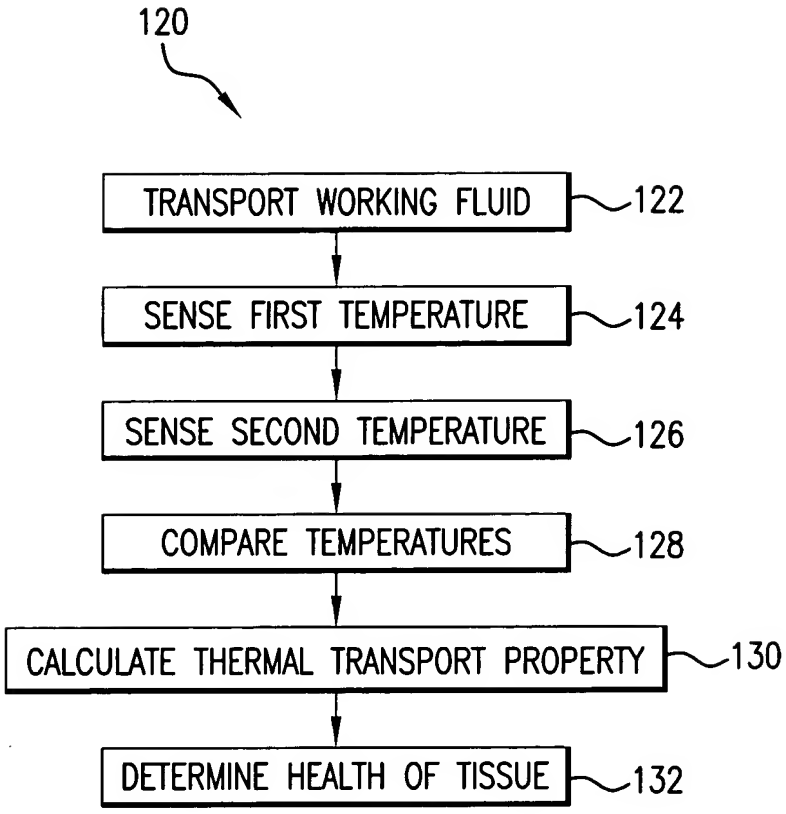
120
TRANSPORT WORKING FLUID
122
SENSE FIRST TEMPERATURE
124
SENSE SECOND TEMPERATURE
126
COMPARE TEMPERATURES
128
CALCULATE THERMAL TRANSPORT PROPERTY
130
DETERMINE HEALTH OF TISSUE
132

FIG.7

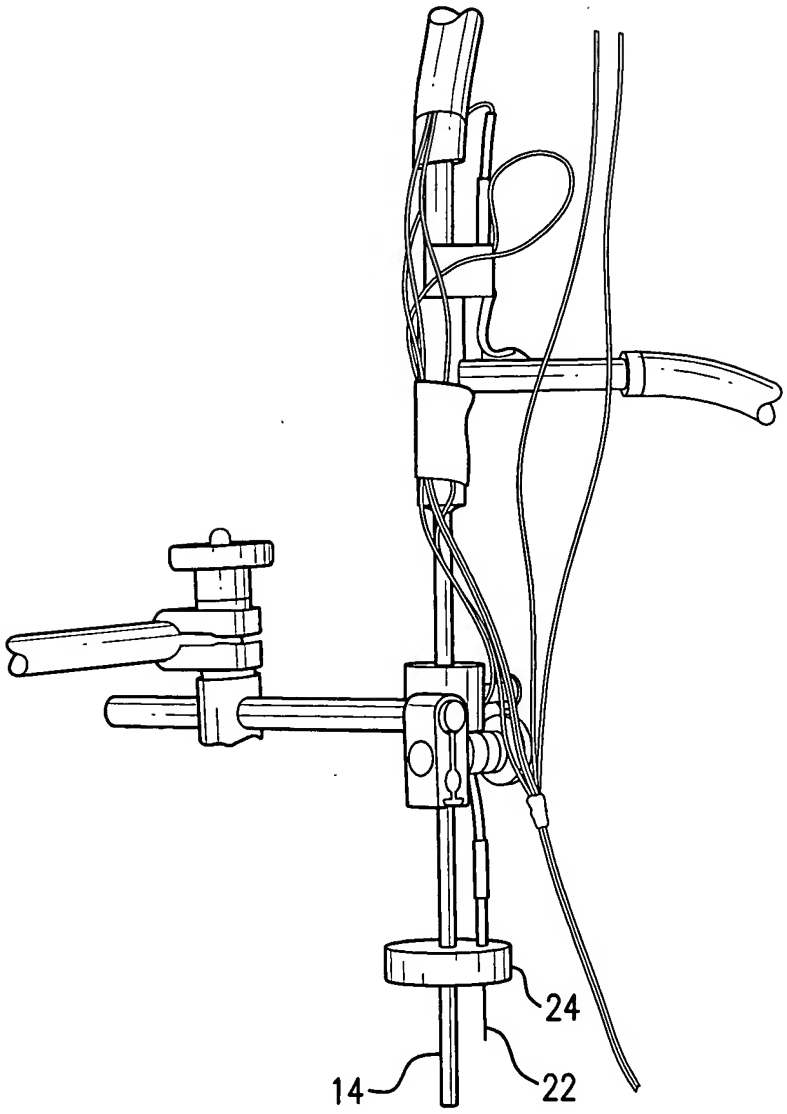

FIG.8

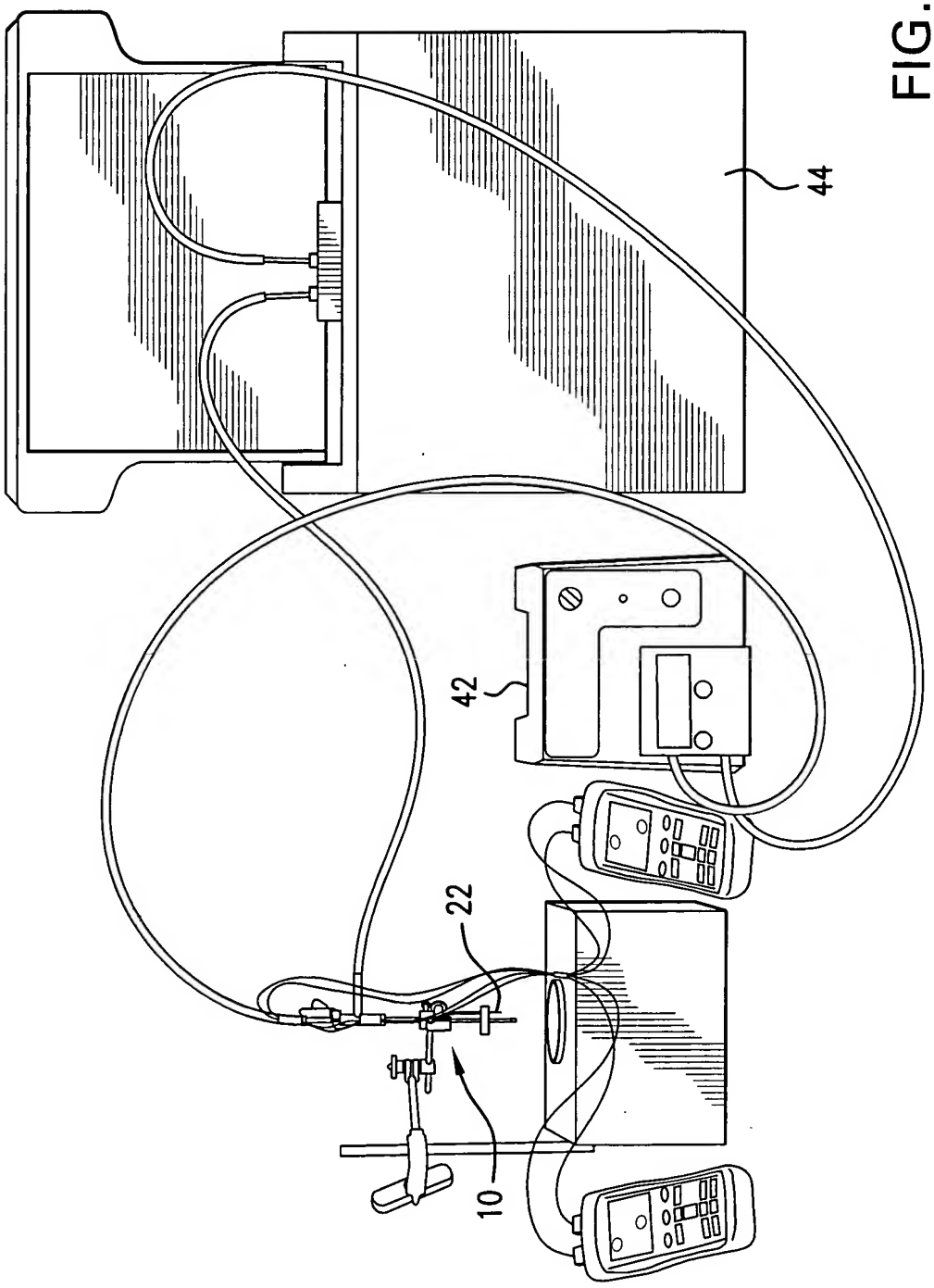

FIG.9

The cooling capacity of the brain cooling device							
Water Properties @ 30C							
ρ	Cp	μ	K				
(kg/m3)	(J/kg-K)	(Pa-s)	(W/m-K)				
996	4180	0.000797	0.617				
		Coolant inlet temperature (C)=		25	25	20	20
		Coolant outlet temperature (C)=		37	30	37	30
		Flow rate (mL/min)=		170	170	170	170
	Maximum cooling capacity (W)=m*Cp*(Tout-Tin)=			141.55	58.98	200.53	117.96
Brain Properties @ 30C							
ρ	Cp	μ	K				
(kg/m3)	(J/kg-K)	(Pa-s)	(W/m-K)				
1080	3850		0.5				
		Temperature drop (C)=		5	5	5	5

FIG.10

		Cooling time (s)=		300	600	900	1200
		Brain radius (m)=		0.055	0.055	0.055	0.055
		Brain volume (m3)=		0.000697	0.000697	0.000697	0.000697
		Brain mass (kg)=		0.752663	0.752663	0.752663	0.752663
	Required cooling capacity (W)=m*Cp*DT=			48.30	24.15	16.10	12.07
Calorimetric Experiments							
Time	Tip Temperature	Calorimeter temperature			Flow rate	Water	
(minute)	(C)	(C)			(mL/min)	(gram)	
			To (C) =	23.3	170	50	
1	10.4	23.3					
2	10.2	23.0					
3	9.7	22.5					
4	9.6	21.9					
5	9.2	21.2					
6	9.1	20.5					
7	8.7	19.7					
8	8.5	19.0					
9	8.2	18.3					
10	8.0	17.8					
			Tf (C) =	16.1			
	Cooling capacity (W)=m*Cp*DT=		2.508				

FIG.10-1

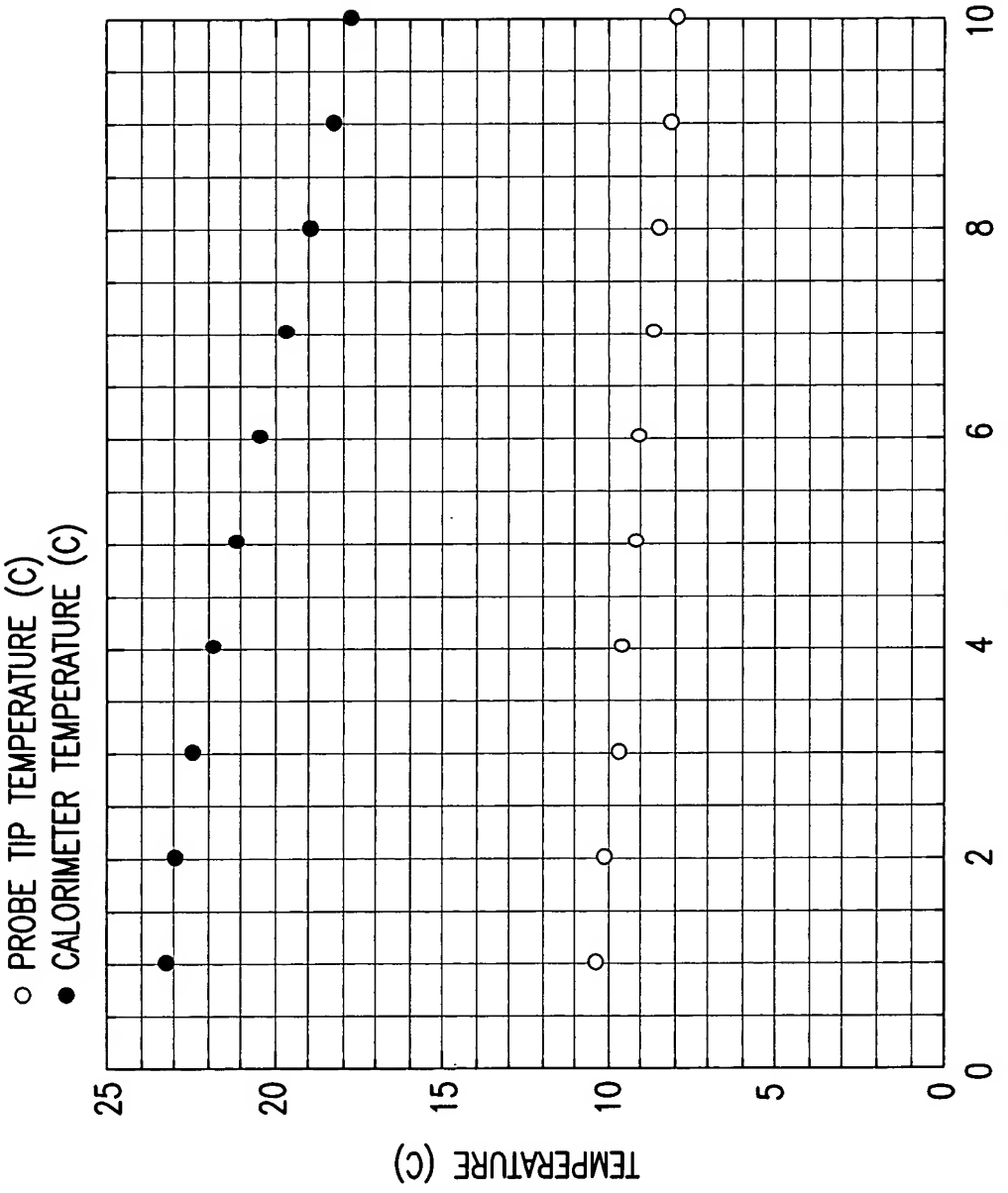
○ PROBE TIP TEMPERATURE (C)
● CALORIMETER TEMPERATURE (C)
TEMPERATURE (C)
25
20
15
10
5
0
0
2
4
6
8
10
TIME (MINUTE)

FIG.11

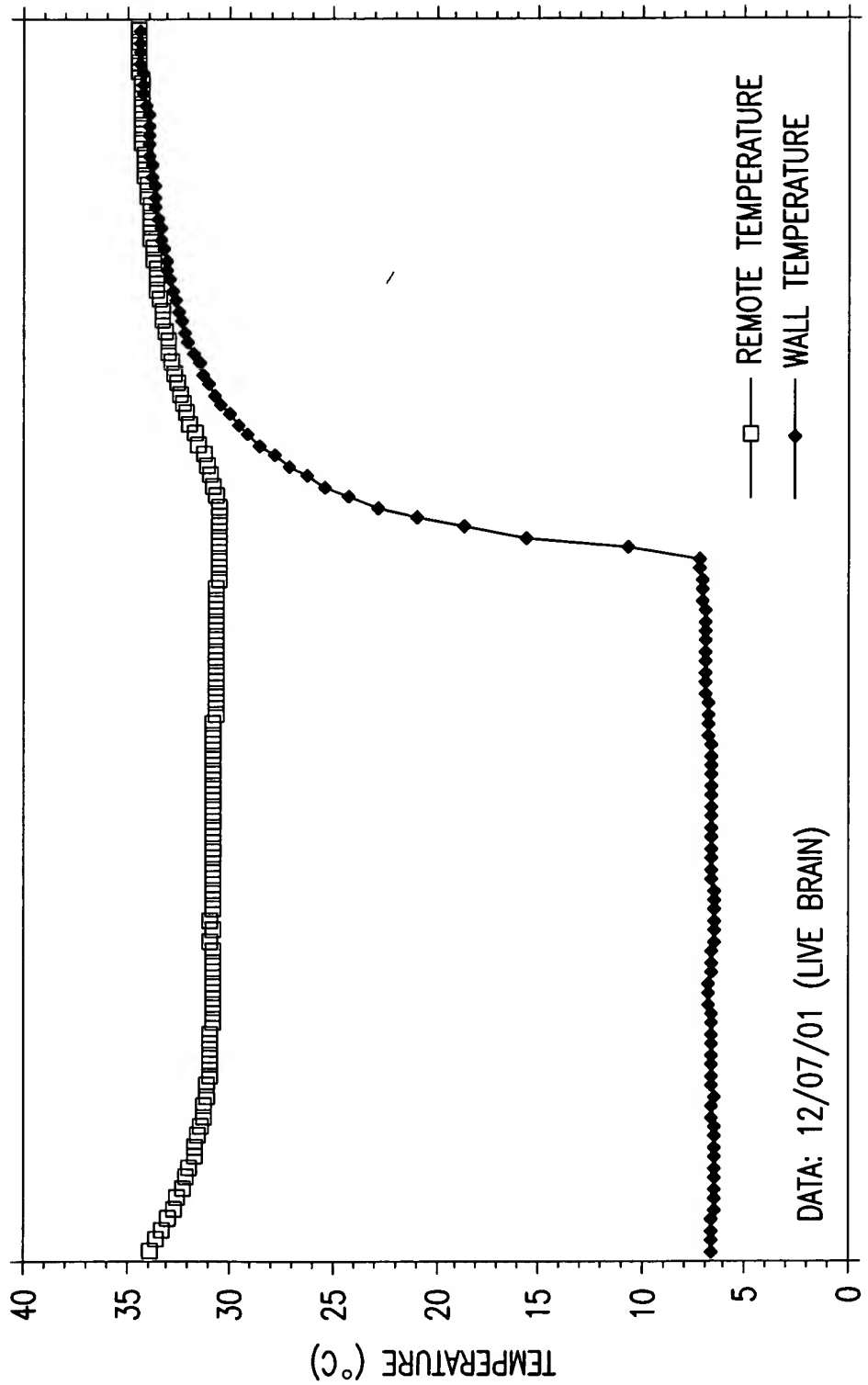
TEMPERATURE (°C)
40
35
30
25
20
15
10
5
0
REMOTE TEMPERATURE
WALL TEMPERATURE
DATA: 12/07/01 (LIVE BRAIN)
TIME
x

FIG.12

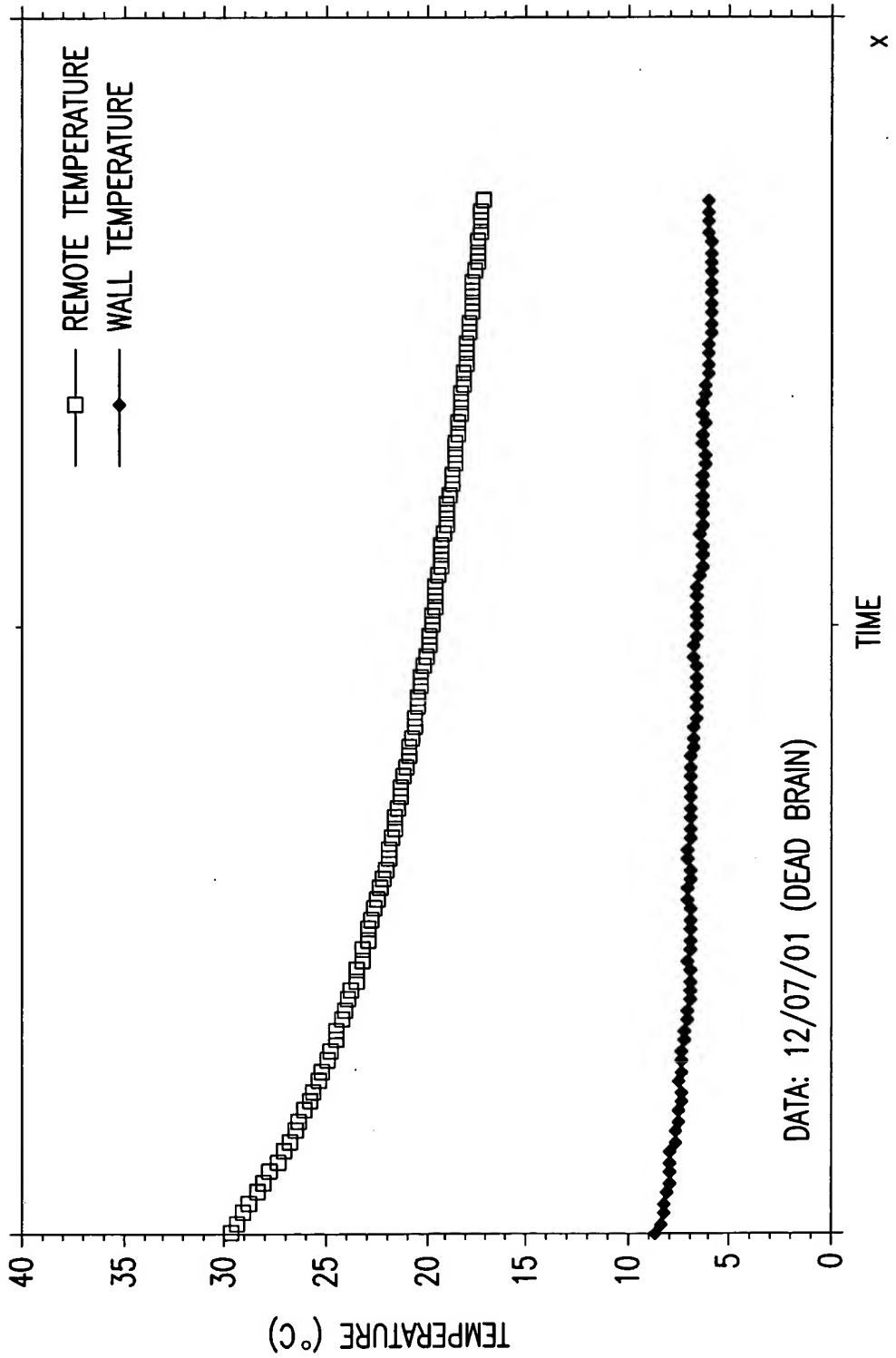
REMOTE TEMPERATURE
WALL TEMPERATURE
DATA: 12/07/01 (DEAD BRAIN)
TEMPERATURE (°C)
TIME
x
40
35
30
25
20
15
10
5
0

FIG.13

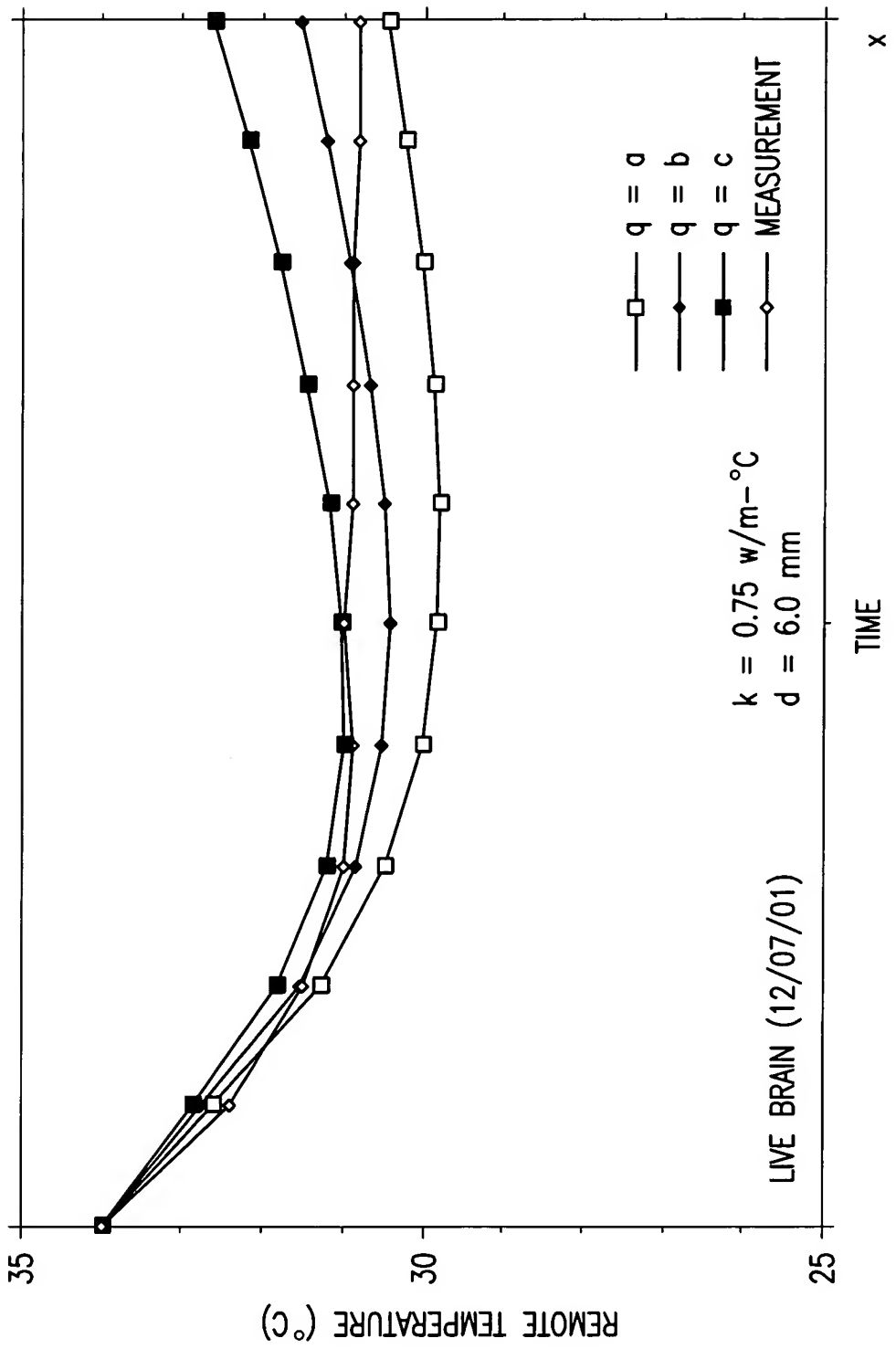
REMOTE TEMPERATURE (°C)
35
30
25
TIME
x
LIVE BRAIN (12/07/01)
k = 0.75 w/m-°C
d = 6.0 mm
q = a
q = b
q = c
MEASUREMENT

FIG.14

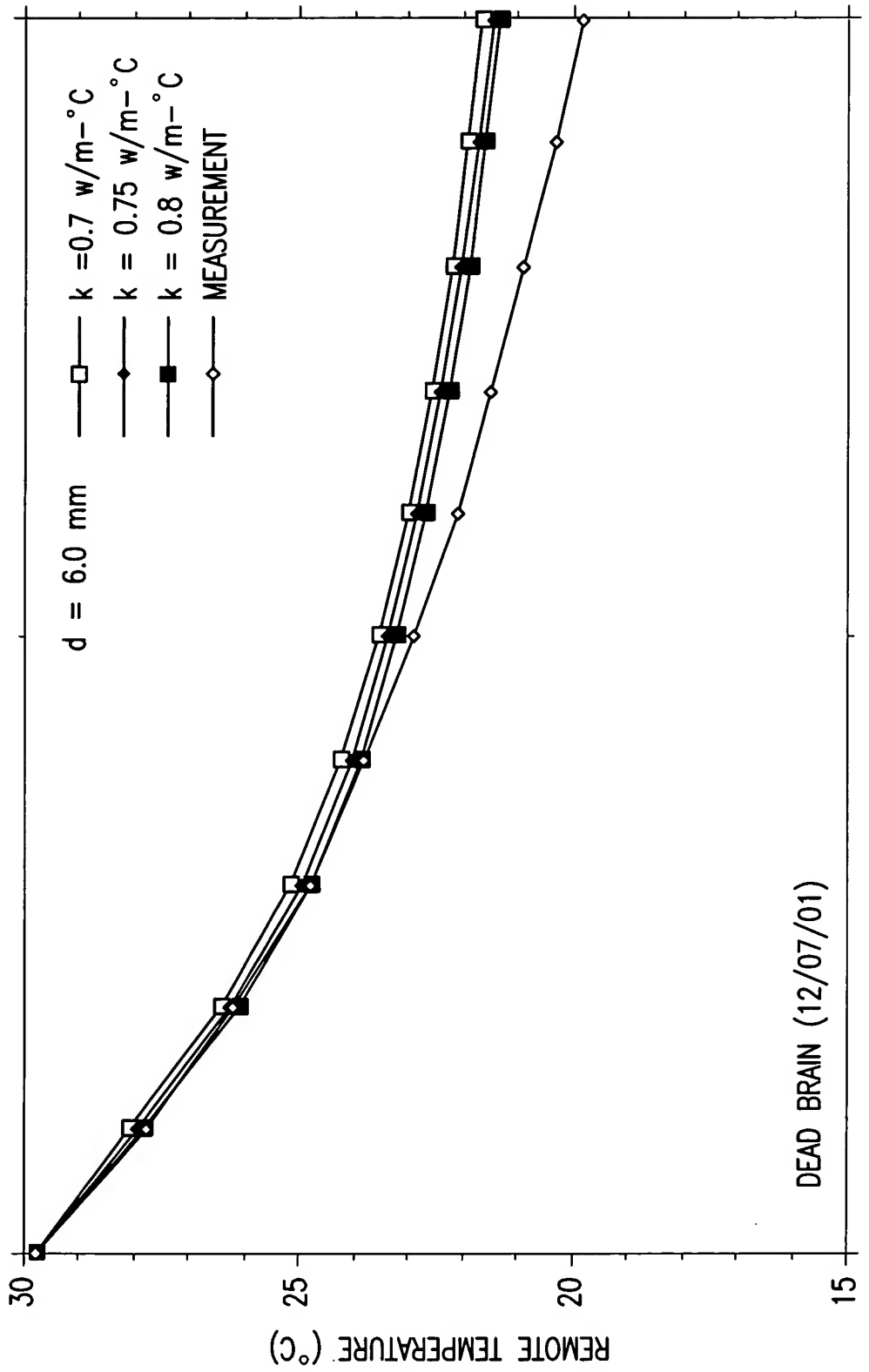
REMOTE TEMPERATURE (°C)
30
25
20
15
TIME
x
d = 6.0 mm
k =0.7 w/m-°C
k = 0.75 w/m-°C
k = 0.8 w/m-°C
MEASUREMENT
DEAD BRAIN (12/07/01)

FIG. 15